APRIL/MAY 2023

GPH23/DPH23 — QUANTUM MECHANICS - II

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions

1. Define non degeneracy.
2. What is the principle of variation method?
3. Express the transition probability for sudden approximation.
4. State Fermi's Golden rule.
5. What is meant by scattering?
6. State the condition of validity of Born approximation.
7. Write down the properties of Dirac matrices.
8. What is meant by magnetic moment?
9. List out the properties of the gamma matrices.
10. Distinguish between creation and annihilation operator.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions

11. (a) Develop the stationary perturbation theory for degenerate level.

Or

(b) Apply WKB method to solve any one application.

12. (a) Using the time dependent perturbation theory, Obtain the first order effect of a harmonic perturbation.

Or

(b) Write a short note on adiabatic approximation.

13. (a) Derive an expression for the differential cross section for scattering in a central potential using partial wave analysis methods.

Or

(b) Discuss the general formulation of scattering theory on the basis of Green's function.

14. (a) Obtain the Dirac equation for a free particle.

Or

(b) If α and β are Dirac matrices, then prove that Trace $(\vec{\alpha}.B)(\vec{\alpha}.C) = 4B.C$.

15. (a) Obtain the covariant form of Dirac equation.

Or

(b) Discuss in detail about the second quantization of Klein – Gordon field.

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions

16. Discuss Variational method and explain it for an application.

17. Develop the time dependent perturbation theory and obtain an expression for probability amplitude.

18. Enumerate the wave packet description of scattering in detail.

19. Derive Klein - Gordon equation for a free particle and hence account for probability and charge densities.

20. Deduce the relativistic invariance of Dirac equation.
